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Guidelines for Applying Group Selection Harvesting

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by

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Introduction

This paper provides a general introduction to the practice of group selection. Much of the information and some of the examples are based on 50 years of research in the northern hardwood type in New England, but the general approach is applicable to other forest types.

What is it?

As the name implies, group selection is a regeneration system in which trees are removed in small groups. This system mimics small-scale natural disturbance and hence stimulates the natural regeneration of certain species well adapted to the subsequent conditions of light and temperature. The groups are not recognized, mapped, or retreated as individual stands; rather individual groups of trees are removed as part of a larger stand. Typically, groups are less than 1/2 acre in size. However, the size of groups depends on the landowner objectives and the light requirements for regenerating desired species. Groups are cut every 15 to 20 years, and the stand area between groups can also be thinned to improve residual tree growth and stand health, and to establish advance regeneration. This regeneration system fosters the development of uneven-aged stands and produces regular yields of forest products, which are sustainable over long periods of time.

Why do it?

Small-scale disturbance

Group selection can closely mimic the natural small-scale disturbance in eastern forests. Large-scale disturbances, like the 1938 hurricane in New England, are infrequent events. In mature eastern forests, trees seem to grow in small groups. These groups of trees grow, mature, and die. They are then replaced by natural regeneration, which continues the process. Group selection is sustainable because it mimics this natural process.

Esthetics

Although properly applied clearcutting is not environmentally damaging, most landowners simply won't allow it on their land. Many people don't like the look of heavy cutting or large clearcuts. For others, the notion of clearcutting conjures up visions of disappearing rain forests or greedy industrialists cutting western old-growth forests. On the other hand, cutting small groups of trees can actually improve esthetics. Newly cut groups open up views of the sky and can create vistas across the landscape. Group selection can diversify what would otherwise be a solid landscape of mature forest. From a distance (e.g., an aerial or mountaintop view), new group cuts can present a checkered appearance (Figures 1 and 2), which adds interest to the landscape. From a lower vantage point, groups become less visible than clearcuts. On public land, group selection generally is acceptable where the public may find clearcutting objectionable.

Regular income

Group selection is an uneven-aged regeneration system which produces a sustainable income every 15 to 20 years. Most even-aged systems produce the income in one or two harvests at the end of the rotation. This is an important consideration for many private landowners who own less than 100 acres and want to have a regular income from timber harvests.

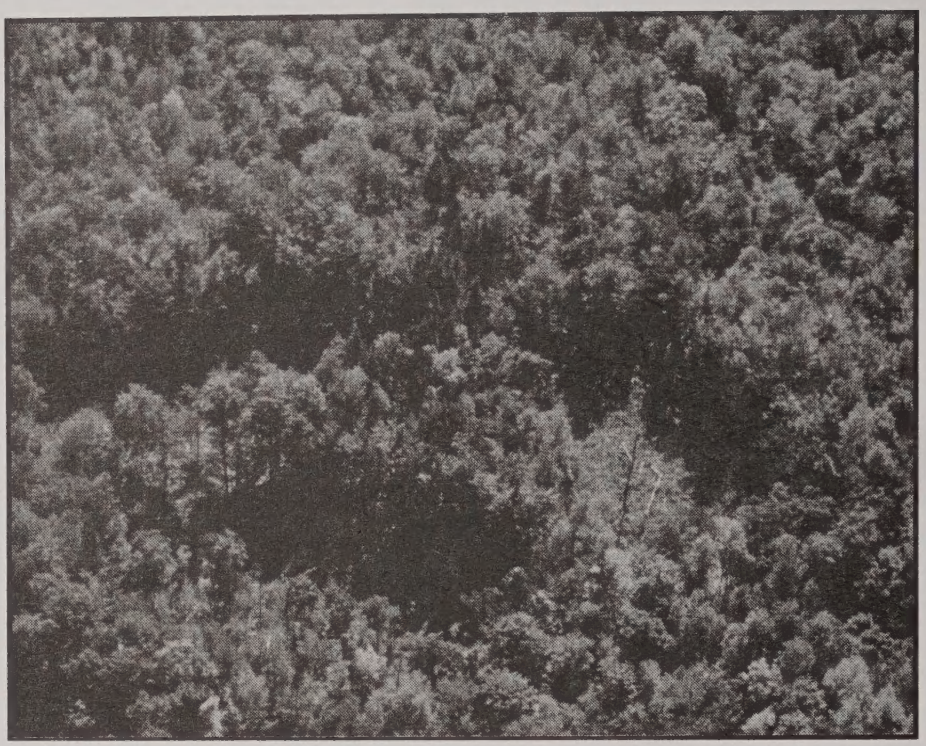

Figure 1. Aerial view of group selection cuts, each about 2/3 acre in size

Regeneration

Light cutting, such as that associated with single-tree selection, tends to regenerate shade tolerant species like beech and sugar maple (tolerants). Regeneration following clearcutting is predominately shade intolerant species such as yellow poplar, paper birch, and aspen (intolerants). Moderate cutting, such as shelterwood cutting, can favor intermediately tolerant species like black cherry, yellow birch, red oak, and white ash (intermediates). By varying the group size, the amount of light reaching the forest floor is increased or decreased, which effectively controls the regeneration species. Control of regeneration species is essential to achieving long-term sustainability.

Implementation

What size of group?

The size of group to be cut is generally determined by the desired regeneration species. The percent of intolerant and intermediate species increases with group size. Small groups, 1/10 acre or less, produce mostly tolerant regeneration. Groups from 1/4 to 2/3 acre usually regenerate a good mixture of intolerants, intermediates, and tolerants. Groups larger than about 2/3 acre tend to have more intolerants than smaller groups, although regeneration composition does tend to be very variable. Figure 3 shows the effect of group size on regeneration species composition in northern New England.

For species dependent upon advance regeneration, such as red oak and white pine, the size of group to be cut is often determined by the aerial extent of the advance regeneration. The group is usually cut slightly larger than the area of advance regeneration, unless advance regeneration is abundant and uniformly distributed throughout the stand.

Technically, there is no upper limit on the size of groups, as long as the groups are not recognized, mapped, or retreated as individual stands. Keep in mind that the primary purpose for cutting groups is to establish regeneration.

Group selection has been successfully applied on large ownerships by cutting groups as large as 2 acres in size.

How many groups?

In the usual case, some element of area control based on the length of time needed to grow mature trees and the planned interval between cuts is used to control the number of groups. For example, if it takes 120 years to grow mature trees and the planned interval between cuts is 15 years, this implies that about 1/8 of the stand acreage should be cut in groups in each entry. After eight cuts, the entire stand would be composed of groups. If the size of groups to be cut is fairly uniform, the number of groups required to treat the stand can be readily calculated. If group size is variable, then one can tally up the estimated group sizes as they are laid out until the appropriate total acreage in groups is reached. This method works well in highly variable stands in the Northeast that have been indiscriminately cut several times. Mature trees are found in small clumps, while diseased beech may occupy up to 2 acres. Group size and shape can also be varied to salvage trees damaged by natural catastrophes such as insect outbreaks, ice storms, or tornadoes.

Harvested volume can be used to control the number of groups (Miller and others 1995). After estimating the periodic volume growth of the stand, groups are established and the stand is thinned between the groups until the volume harvested is equal to the periodic volume growth. This requires a convenient way to compute volume, as a running total of harvested volume must be maintained. Group size is determined by light requirements of the desired species.

Where to locate the groups?

Most hardwood stands are actually composed of natural groups of trees. These stands lend themselves to group selection. Mature trees can be harvested in groups. The stand composition can be improved by harvesting groups of diseased trees, such as beech infected with the beech bark disease (Mielke and others 1986).

Figure 2. Aerial view of group selection cuts, each about 1/2 acre in size and placed on a grid (photo courtesy of J.D. Irving, Ltd., Deersdale, NB, Canada)

Laying out the required acreage and number of groups, and distributing these groups throughout the stand has been approached in several different ways. Usually a preliminary examination is conducted to establish the size and number of groups to be cut. It is best to consider the stand conditions to determine group location. Placing groups on a fixed grid is not recommended unless the stand is quite uniform. On the other hand, traversing the stand without any spacing control may lead to excess cutting in certain portions of the stand and minimal cutting in other harvestable areas. One possibility is to follow these steps: (1) use the estimated number of groups to determine a rough spacing, (2) pace the distance between grid points, and (3) at each grid point, establish a group at the nearest location that has the appropriate overstory/understory conditions.

When a new group is located near an old group, it is best to put the new group right against the old group without leaving a narrow strip of trees that cannot easily be accessed in future cuts.

Another option is to enlarge some old groups rather than create all new ones. A strip wide enough to create desirable light conditions is cut around existing groups. This method has been used successfully in Europe, although it is a bit more difficult to compute the acreage of cut groups.

Should small trees be cut?

If the goal is to encourage maximum amounts of regeneration from seed or stump sprouts within groups, then all stems larger than 2 inches diameter breast height (d.b.h.) should be removed. This is the recommended procedure to regenerate yellow poplar, black cherry, paper birch, and yellow birch (Figure 4). The small, unmerchantable stems are usually cut at the same time the merchantable material is removed to cut the groups.

With other species, however, some small trees are left in the groups. This is a common situation with red oak, white pine, tolerant

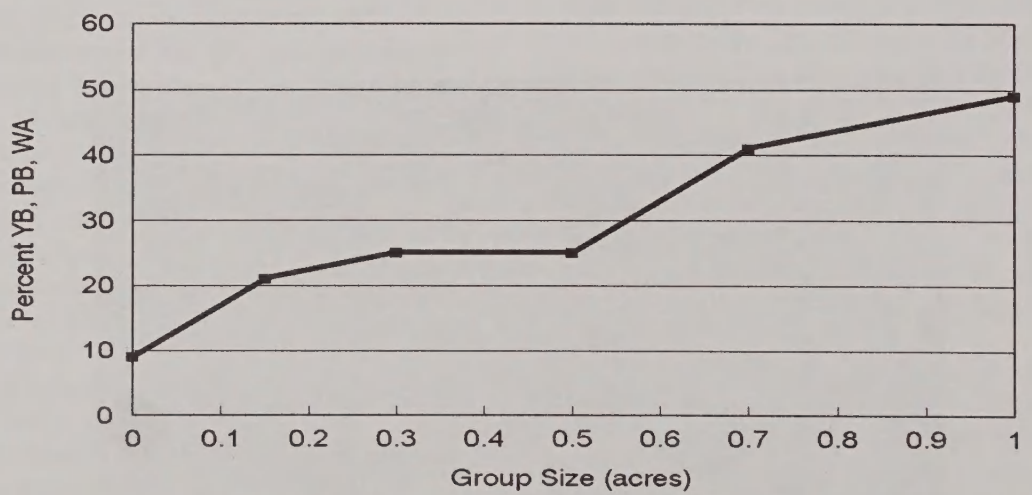

Figure 3. Numbers of yellow birch (YB), paper birch (PB), and white ash (WA) regeneration as a percent of the total commercial species plotted over complete-removal group size (adapted from data in Leak and Smith 1997, Leak and Wilson 1958, Marquis 1965, and McLure and Lee 1993)

softwoods such as spruce, fir, or hemlock, and sometimes with sugar maple or ash. The procedure is to identify clumps of desired advance regeneration and then to remove the overtopping overstory trees. It is necessary to take appropriate precautions to protect the advance regeneration through snow cover and careful logging methods.

In northern New England, advance beech regeneration can interfere with more desirable species. A dense understory of beech often develops in stands that have been lightly cut or where the beech bark disease has weakened or killed overstory beech. In such cases, it is recommended to cut all the stems larger than 2 inches d.b.h. to control the beech regeneration. Failure to do so will predispose the regeneration within groups to be dominated by beech.

How to locate skid trails?

The usual method of locating skid trails is to simply locate the main skid trails and connectors that are needed to access all the new groups. Assuming that the new groups are fairly well distributed over the stand, the first entry will result in the construction of most of the main skid trails. Subsequent entries will require that fewer new main skid trails be constructed. Over time, a stand will gradually be entirely cut over, and all the skid trails will be constructed. Figure 5 shows a stand on the Bartlett Experimental Forest in New Hampshire that has been about 50% cut over during the last 60 years (about a 120-year rotation).

Another way is to locate and construct all the main skid trails before any groups are designated. During the first entry, all the main skid trails are constructed, as well as any connectors needed to access groups. The advantage of this method is that roads are not constructed through existing groups in future cuts. However, it does incur the cost of constructing all the main skid roads during the first entry.

Thinning between the groups or not?

Thinning the stand between the groups is the normal procedure when applying group selection. Such thinning is needed to maximize timber growth and quality. It can also provide the volume needed for a commercial timber sale when there is insufficient volume in the cut groups. However, group selection can be successfully applied without thinning between the groups, as might be the case where the characteristics of a mature forest are desired. If thinning between the groups is undertaken, it is best for a professional forester to supervise this operation. The following discussion provides some guidelines for professional foresters to use when thinning between groups.

It is generally recommended to leave a residual basal area between the groups of about 70 square feet/acre, excluding the new groups (Leak and others 1986). It is also recommended that 40–50 square feet/acre of the residual basal area be left in sawtimber to ensure that there will be adequate volume for future cuts. This also prevents diameter limit cutting, a practice that generally is not sustainable. It has been suggested that this thinning can follow single-tree selection guidelines in terms of residual density and stand structure. However, after several group selection cutting cycles, the stand will become a mosaic of groups, and applying single-tree selection guidelines will be quite challenging. In practice, marking between the groups usually resembles an improvement cut or thinning that favors the development of groups of overstory trees. After one or two group selection cutting cycles, some of the thinning between groups will be in the older groups where crop tree release, weeding, cleaning, or other timber stand improvement can be undertaken.

Concentrate cutting between groups along existing skid trails and around the edges of new groups. In this way, regeneration in older groups can be avoided and damage to residual trees can be minimized. Large trees that lean towards newly cut groups should be cut to prevent future damage to regeneration or young stands developing within the groups. There is some concern that trees along group borders will decline in quality since they are drastically exposed on one side. This has not been a significant problem, although it is well known that such exposure may trigger epicormic branching or the maintenance of live limbs. For that reason, it is recommended to leave border trees that will suffer little quality loss (e.g., trees with dominant crowns, wildlife trees, and small trees that will not compete with the trees developing in the new groups).

Thinning between the groups will increase the amount of advance tolerant regeneration. Where this advance generation is of a desirable species, clumps of regeneration can be released by cutting future groups. If the advance regeneration is undesirable (e.g., beech or sometimes fir), it can be removed when new groups are cut.

Wildlife considerations

Group selection creates a range of wildlife habitats, from newly regenerated groups to mature forest. It provides browse, cover, and nesting sites. Group size and shape can be varied to produce habitats for a wide variety of wildlife species. Leaving some trees that would normally be harvested for timber products can increase coarse woody debris and the number of standing cavity trees.

Group selection has only a moderate impact on breeding bird populations. One study showed that recent clearcuts, early group selection cuts, and mature stands were used by 46, 33, and 30 bird species, respectively (Costello 1995). Only a few bird species were found in the mature, unmanaged stands that were not found in the group selection areas. About 13 breeding bird species were found only in large clearcuts.

Beech is an important wildlife species, but throughout most of its natural range, beech bark disease has reduced the amount of beechnut production. Group selection can be used to increase the amount of beechnut production. First, using small groups (less than 1/4 acre) can successfully regenerate beech. Second, when thinning between the groups, individual beech trees that show resistance to the disease can be released to produce larger crowns and hence more beechnuts. And third, the best beech can be retained in the stand and never cut. This can be accomplished by locating newly cut groups so that desirable beech is left on the edge of the groups. This will promote crown development on the desirable beech, while encouraging other

Figure 4. A complete-removal group in northern hardwoods, about 3/4 acre in size

species of regeneration within the newly cut groups. When new groups are cut adjacent to existing groups, the same beech can be retained along the edges of newly cut groups. Thus, the most desirable beech will be retained and fully released while not interfering with the development of regeneration within groups.

Summary

Group selection is a regeneration system in which trees are removed in small groups. This system mimics natural disturbance and hence stimulates the natural regeneration of certain species well adapted to the subsequent conditions of light and temperature. The groups are not recognized, mapped, or retreated as individual stands.

Many private forestland owners appear to prefer group selection to larger clearcuts because small openings are more acceptable than large cuts.

Newly cut groups can improve esthetics by opening up views of the sky and creating vistas.

Group selection is a good timber producing system. Our experience in New England forest types is that group selection harvesting produces enough high quality, large diameter logs at each harvest so that it is economical and readily accepted by loggers. Group selection is an uneven-aged system which produces a sustainable income every 15 to 20 years. This is an important consideration for many landowners who own less than 100 acres and want to have a regular income from timber harvests.

Group selection is a very flexible regeneration system. Group size can be varied to favor regeneration conditions for a variety of species. Wildlife habitats can be improved by varying the group sizes and varying the treatments between groups.

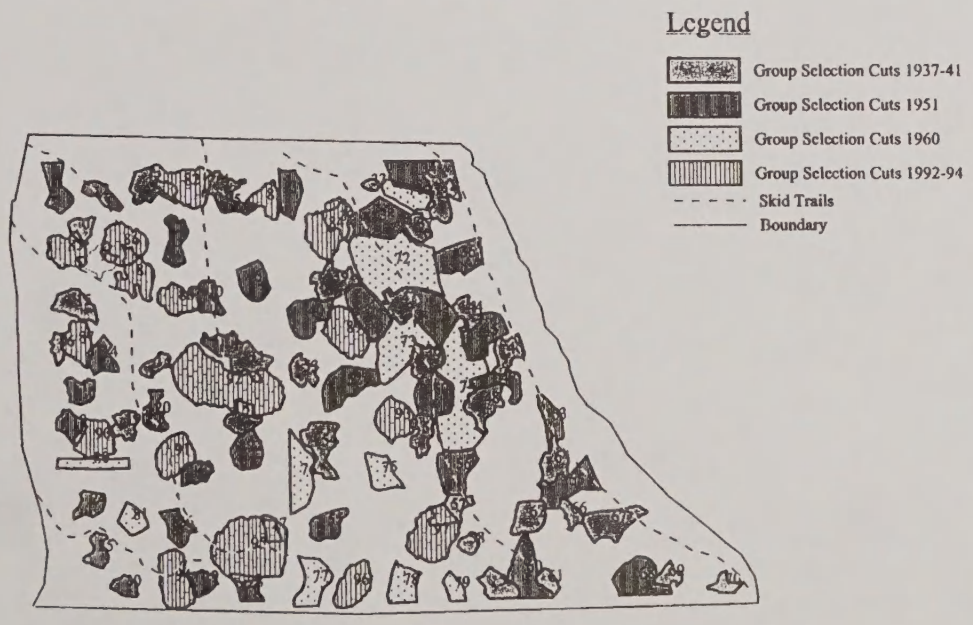

Figure 5. Map of a 114-acre stand on the Bartlett Experimental Forest after four group selection cuttings (map prepared by William Frament, USDA Forest Service, Durham, NH)

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